Scientific Instruments for GLOBE Measurements

A number of instruments, supplies, and pieces of equipment are needed to conduct the GLOBE measurements properly. Many of these can be purchased from suppliers while some can be made by students or individuals in the school community. The GLOBE measurements and instruments are differentiated by skill level. In the KIT Column of the following table, B, I, and A indicate that an instrument is included in a beginning (B), intermediate (I), or advanced (A) level kit. Each kit includes the minimum set of instruments which most schools will need to purchase in order to do the GLOBE protocols appropriate for their educational level. O indicates that purchase of this instrument is optional and that it is not included in a kit either because most schools should already have access to one, because schools in an area can reasonably share one instrument, or because the instrument is needed only if certain options within the GLOBE protocols are chosen. M indicates that the instrument can be made at the school or with local assistance.

Instrument	Kit (B,I,A,O,M)	Measurement	Skill Level
Cloud chart	O[1]	Cloud Cover/Type	All
Maximum/Min. Thermometer	B,I,A	Air Temperature - Max/Min. & Current Temperature	All
Calibration thermometer (Organic liquid-filled thermometer)	B,I,A	Air Temperature, Water Temperature, Salinity, Soil Particle Size	All
Instrument Shelter	B,I,A,M	Air Temperature	All
Rain gauge	B,I,A	Precipitation, Liquid, Solid	All
Snow board	M	Precipitation, Solid	All
Snow depth pole	O,M	Precipitation, Solid	All
pH indicator paper	B	Precip. pH, Water pH, Soil pH	Begin.
pH pen	I	Precip. pH, Water pH, Soil pH	Int.
pH 7 buffer	I,A,M	Precip. pH, Water pH, Soil pH	Int., Adv.
pH meter	A	Precip. pH, Water pH, Soil pH	Adv.
pH 4 and pH 10 buffers	A,M	Precip. pH, Water pH, Soil pH	Adv.
Dissolved oxygen kit	I,A	Dissolved Oxygen	Int., Adv.
Water alkalinity kit	I,A	Alkalinity	Int., Adv.
Safety Equipment – Plastic gloves and goggles	I,A	Hydrology: Dissolved Oxygen, Alkalinity, Salinity, Titration Nitrate	Int., Adv.
Total dissolved solids (conductivity) tester	B,I,A[2]	Electrical Conductivity – Fresh water sites only	All
Calibration solution	B,I,A,M[2]	Electrical Conductivity – Fresh water sites only	All

1 One copy provided to each GLOBE teacher at training

2 Include in kit only for freshwater sites

Instrument	Kit (B,I,A,O,M)	Measurement	Skill Level
Hydrometer	B,I,A	Soil: Particle Size, Salinity – Brackish/salt water only	All
500 mL clear plastic graduated cylinder	B,I,A	Soil: Particle Size, Salinity – Brackish/salt water only	All
Salinity kit	O	Salinity — Titration Method	Optional, Int., Adv.
Water Nitrate kit	I,A	Hydrology: Nitrate	Int., Adv.
Secchi Disk, Rope	O,M	Transparency — Deep water site only	All
Turbidity tube	M	Transparency Shallow water site	All
Remote sensing image data	See footnote[3]	Land Cover Mapping	All
MultiSpec software	See footnote[4]	Land Cover Mapping	All
Dichotomous keys	O[5]	Species Identification	All
50 m tape measure	B,I,A	Site Layout, Tree Circumference, Tree Height	All
Clinometer	O,M	Tree Height, Slope	All
Densiometer	M	Canopy Cover	All
Plant clippings drying oven	O	Grass Biomass	All
Dutch auger[6]	O	Soil: Profile, Bulk Density, Soil Moisture	All
Sand auger[6]	O	Soil: Profile, Bulk Density, Soil Moisture	All
Peat auger[6]	O	Soil:Profile, Bulk Density, Soil Moisture	All
Bucket auger[6]	O	Soil:Profile, Bulk Density, Soil Moisture	All
Shovel	O	Soil:Profile, Bulk Density, Soil Moisture	All
Camera	O	Soil Profile, Land: Site Layout	All
Meter stick	O	Soil: Depth, Soil Moisture	All
Color chart	B,I,A	Soil Color	All
Distilled white vinegar	O	Soil: Free Carbonates	All
Acid squirt bottle	B,I,A	Soil: Free Carbonates	All
#10 sieve (2 mm mesh)	B,I,A	Soil: Bulk Density, Particle Size	All
Soil drying oven	O	Soil: Moisture, Bulk Density	All
Balance	O	Gravimetric Soil Moisture, Soil Bulk Density	All

3 Remote sensing image data provided by GLOBE or Country Coordinator
4 Downloadable from Purdue University http://dynamo.ecn.purdue.edu/~biehl/MultiSpec/Index.html
5 Choose a dichotomous key appropriate to local vegetation; a generally applicable dichotomous key will be provided to each teacher at training
6 Select auger appropriate for local soil type

Instrument	Kit (B,I,A,O,M)	Measurement	Skill Level
Soil cans - 15	O,M	Gravimetric Soil Moisture Soil Bulk Density —	All
		Pit or surface method	
Other soil containers	O	Gravimetric Soil Moisture Soil Bulk Density	All
Dispersing solution	B,I,A,M	Soil: Particle Size	All
100 mL graduated cylinder	B,I,A	Soil pH, Bulk Density	All
Soil NPK kit	I,A	Soil Fertility	Int., Adv.
Garden Trowel	O	Gravimetric Soil Moisture	All
PVC Pipe	O,M	Gypsum Block Soil Moisture	Optional Adv.
Gypsum Blocks (4 required)	O	Gypsum Block Soil Moisture	Optional Adv.
Soil Moisture Meter	O	Gypsum Block Soil Moisture	Optional Adv.
Dual Ring Infiltrometer	O,M	Soil: Infiltration	All
Soil Thermometer	B,I,A	Soil: Temperature	All
Global Positioning System receiver	O[7]	Latitude, longitude and elevation	All

[7] Available from GLOBE/UNAVCO